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10/812,717

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Francimar Schmitt

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EXAMINER

LAFOND, RONALD D

ART UNIT

PAPER NUMBER

1709

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/812,717

Applicant(s)

SCHMITT ET AL.

Examiner

Ronald D. Lafond

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 06/28/04, 10/21/05.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
2. Claims 7 – 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
3. The term "sccm/cm²ⁿ" in claim 7 is a relative term that renders the claim indefinite. The term "sccm/cm²ⁿ" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The specification does not define what type of area should be used as the denominator to arrive at this irregular flow/velocity term; reactor cross-sectional area, substrate surface area, and chuck surface area are but three possible areas that could be used to arrive at this unit of measurement. Moreover, the specification is unclear as to the shape of substrates if, as is assumed, substrate surface area is the area that is to be used in this calculation. The term has been construed as at least inclusive of sccm (gas flow) / [substrate surface area] (cm²), wherein the substrate is assumed to have a circular surface and the substrate size given in the specification is the substrate diameter.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 15 – 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Li, et al (United States Patent Application Publication 2003/0194495, filed April 11, 2002).

The applied reference has a common assignee, Applied Materials, Inc., with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

6. Li teaches, as in Claims 15 and 16 of the present application, a method for depositing a low dielectric constant film comprising: a) delivering a gas mixture comprising: I) a cyclic organosiloxane; II) a linear hydrocarbon having at least one unsaturated carbon-carbon bond; and III) two or more oxidizing gases comprising N_2O and O_2 to a substrate in a chamber; and b) applying RF power to the gas mixture at conditions sufficient to deposit a low dielectric constant film on a surface of the substrate. (See Paragraph [0015] of Li: "Embodiments of the invention include a significant and unexpected reduction in dielectric constants for films containing silicon, oxygen, and carbon by blending one or more cyclic organosilicon compounds and one or more aliphatic compounds with an oxidizing gas at conditions sufficient to form an ultra low dielectric constant film (k less than 2.5)." See also claim 1 of Li: "A method for depositing a low dielectric constant film having a dielectric constant of about 3.0 or less, comprising: reacting a gas mixture comprising: one or more cyclic organosilicon compounds; one or more aliphatic compounds; and one or more oxidizing gases; and delivering the gas mixture to a substrate surface at conditions sufficient to deposit the low dielectric constant film on the substrate surface." With regard to cyclic organosiloxanes, see Paragraph [0016] of Li: "The cyclic organosilicon compounds include a ring structure having three or more silicon atoms and the ring structure may further comprise one or more oxygen atoms. Commercially available cyclic organosilicon compounds include rings having alternating silicon and oxygen atoms with one or two alkyl groups bonded to the silicon atoms." With regard to linear hydrocarbons, see Paragraph [0052] of Li: "The aliphatic compounds also include aliphatic hydrocarbon

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compounds ... The hydrocarbon compounds can include adjacent carbon atoms that are bonded by any combination of single, double, and triple bonds. For example, the organic compounds may include alkenes." With regard to oxidizing gases, see Paragraph [0053] of Li: "The one or more oxidizing gases may include oxygen (O₂), ... nitrous oxide (N₂O), ... or combinations thereof." With regard to applying RF power to the gas mixture, see Paragraphs [0056] or [0057] of Li).

7. Regarding Claims 17 and 18, Li teaches the method of claim 15, wherein the cyclic organosiloxane is octamethylcyclotetrasiloxane (OMCTS) (see Paragraph [0019] of Li).

8. Regarding Claim 19, Li teaches that the linear hydrocarbon is ethylene (see Paragraph [0052] of Li, "For example, the organic compounds may include alkenes, such as ethylene").

9. Regarding claim 20, Li also teaches the method of Claim 15, wherein the gas mixture further comprises an inert gas selected from the group consisting of helium, argon, and mixtures thereof (see Paragraph [0077] of Li).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary.

Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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12. Claims 1 – 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li, and further in view of Allman, et al (United States Patent 6,211,096).

13. Regarding Claims 1 and 2, as in Claims 15 and 16, Li teaches a method for depositing a low dielectric constant film comprising: a) delivering a gas mixture comprising: I) a cyclic organosiloxane; and II) two or more oxidizing gases comprising N_2O and O_2 to a substrate in a chamber; and b) applying RF power to the gas mixture at conditions sufficient to deposit a low dielectric constant film on a surface of the substrate (see explanation given in Paragraph 6 of this Action, above.)

However, Li does not teach that the ratio of a flow rate of the N_2O to a total flow of the two or more oxidizing gases into the chamber is between about 0.1 and about 0.5. Allman teaches just such a limitation, wherein, in a plasma-enhanced chemical vapor deposition (PE-CVD) process, adjusting the relative amounts of N_2O or O_2 used in an oxidizing gas stream consisting of only N_2O and O_2 can allow the user to tune the dielectric constant of the oxide film produced (see Summary of the Invention, Column 2, lines 48-67 of Allman). In one embodiment, Allman teaches a flowrate of 2 l/min for N_2O and 6 l/min for O_2 , for a ratio of the flow rate of the N_2O to the total flow of the oxidizing gases into the chamber of 0.25 (see Column 7, lines 6-8 of Allman), which falls within the range claimed by Applicants. As it states in the Abstract of Allman, "By controlling the ratio of nitrogen to oxygen in the source gas as used in the CVD method, the ultimate nitrogen, carbon ... concentrations in the film can be controlled and hence the dielectric constant of the film produced." Therefore, it would have been obvious to one having ordinary skill in the art at the time this application was filed to have used an oxidizing gas composition as described in Allman to have further tuned the dielectric constant of the film being produced via the PE-CVD process disclosed in Li with a reasonable expectation of success.

14. Regarding Claims 3 – 5, Li teaches, as in Claims 3 and 4, that the cyclic organosiloxane is OMCTS (see Paragraph [0019] of Li). Li also teaches, as in Claim 5, that the gas mixture further comprises an inert gas selected from the group consisting of helium, argon, and combinations thereof (see Paragraph [0077] of Li).

15. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Li and Allman as applied to Claim 1 above, and further in view of Ross, et al (United States Patent 6,582,777).

Li and Allman do not teach the method of Claim 1, further comprising post-treating the low dielectric constant film with an electron beam. Ross teaches just such a limitation (see Summary of the Invention of Ross, Column 3, lines 55 – 60, “The invention also provides a process for forming a dielectric layer on a substrate which comprises chemical vapor depositing a dielectric layer on a substrate and then exposing the chemical vapor deposited dielectric layer to electron beam radiation for a sufficient time, temperature, electron beam energy and electron beam dose to reduce the dielectric constant of the layer.”) Because the aim of the current application is to deposit a low dielectric constant film via CVD, it would have been obvious to one having ordinary skill in the art at the time this application was filed to have used the e-beam treatment disclosed in Ross to have further reduced the dielectric constant of the low dielectric constant film produced by the method disclosed in Li, and further in view of Allman, with a reasonable expectation of success.

16. Claims 7 – 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li. Li teaches, as in Claims 7 and 8, a method for depositing a low dielectric constant film, comprising: a) delivering a gas mixture comprising: I) a cyclic organosiloxane; and II) an oxidizing gas comprising N_2O to a substrate in a chamber; and b) applying RF power to the gas mixture at conditions sufficient to deposit a low dielectric constant film on a surface of the substrate (see explanation given in Paragraph 6 of this Action, above).

However, Li does not explicitly teach this method wherein the N_2O is delivered into the chamber at a flow rate between about 0.71 sccm/cm^2 and about 1.42 sccm/cm^2 . Li also teaches that “the oxygen containing gas has a flowrate between about 100 and about 6,000 sccm” (see Paragraph [0061]). Li describes this process for a 200 mm substrate (see Paragraph [0063]), which has a surface area of about 300 cm^2 , assuming a circular substrate with a 200 mm diameter; this corresponds to a flow rate of between about 0.32 and about 19 sccm/cm^2 , which completely encompasses and thus anticipates the range of about 0.71 sccm/cm^2 to about 1.42 sccm/cm^2 of claim 7. (“In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a *prima facie* case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Circ. 1990)” See MPEP 2144.05). Therefore, it would have been obvious to one having ordinary skill in the art to have chosen a flow rate from within the disclosed operative range, such as $0.71 - 1.42$

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sccm/cm², with a reasonable expectation of success because Li teaches that such conditions are suitable for deposition.

17. Regarding Claims 9 and 10, Li teaches the method of Claim 7, wherein the gas mixture further comprises a linear hydrocarbon, and wherein the linear hydrocarbon is ethylene (With regard to linear hydrocarbons, see Paragraph [0052] of Li: "The aliphatic compounds also include aliphatic hydrocarbon compounds ...". Li teaches that the linear hydrocarbon is ethylene (see Paragraph [0052] of Li, "For example, the organic compounds may include alkenes, such as ethylene.") Li also teaches, as in Claims 11 and 12, that the cyclic organosiloxane is OMCTS (see Paragraph [0019] of Li). Finally, Li also teaches, as in Claim 13, that the gas mixture further comprises an inert gas selected from the group consisting of helium, argon, and combinations thereof (see Paragraph [0077] of Li).

18. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Li as applied to Claim 7 above, and further in view of Ross, for substantially the same reasons applied to Claim 6 above.

Double Patenting

19. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

20. Claims 15 – 20 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 9, and 13 – 14 of U.S. Patent No. 6,797,643. Although the conflicting claims are not identical, they are not patentably distinct from each other because all the limitations of the listed claims from the instant application are anticipated by the listed claims of the 6,797,643 patent.

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Claims 15 and 16 of the present application read directly on Claim 1 of the '643 patent, although Claim 1 of the '643 patent does not require that the one or more oxidizing gases of the gas mixture comprise or consist of N_2O and O_2 . However, the '643 patent discloses in the Specification, in Column 4, lines 1 – 4, that, "The one or more oxidizing gases may include oxygen (O_2), ..., nitrous oxide (N_2O), ... or combinations thereof." Claims 17 and 18 of the present application read directly on Claims 9 and 13 of the '643 patent; Claim 19 of the present application reads directly on Claim 14 of the '643 patent. Finally, Claim 20 of the present application reads directly on Claim 1 of the '643 patent, wherein the gas mixture further comprises an inert gas selected from the group consisting of helium, argon, and mixtures thereof, as disclosed in the Specification of the '643 patent in Column 9, lines 14 – 22.

21. Claims 1 – 5 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 9, and 13 – 14 of U.S. Patent No. 6,797,643, and further in view of Allman, for substantially the same reasons given for Claims 1 – 5 above.

22. Claim 6 is rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of U.S. Patent No. 6,797,643 in view of Allman, and further in view of Ross, for substantially the same reasons given above regarding Claim 6.

23. Claims 7 – 13 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 9, and 13 – 14 of U.S. Patent No. 6,797,643, and further in view of Li. Claims 7 and 8 of the present application read directly on Claim 1 of the '643 patent, although Claim 1 of the '643 patent does not require that the oxidizing gas comprising or consisting of N_2O be delivered into the chamber at a flow rate of between about 0.71 and 1.42 sccm/cm². However, Li discloses just such a limitation, as described above. Therefore, it would have been obvious to one having ordinary skill in the art at the time this application was filed to have used the N_2O flow rates disclosed in Li in the film deposition process disclosed in the '643 patent with a reasonable expectation of success, because Li teaches that such conditions are suitable for deposition (see Paragraph [0061] of Li, and Paragraph 16 in this Action for further analysis). Claims 9 and 10 of the present application read directly on Claim 14 of the '643 patent, and further in view of Li. Claims 11 and 12 of the present application read directly on Claims 9 and 13 of the '643 patent, and further in view of Li. Claim 13 of the present application reads

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directly on Claim 1 of the '643 patent, and further in view of Li, wherein the gas mixture further comprises an inert gas selected from the group consisting of helium, argon, and mixtures thereof, as disclosed in the Specification of the '643 patent in Column 9, lines 14 – 22.

24. Finally, Claim 14 is rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of U.S. Patent No. 6,797,643 in view of Li, and further in view of Ross, for substantially the same reasons given above regarding Claim 6.

Conclusion

25. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ronald D. Lafond whose telephone number is (571) 270-1878. The examiner can normally be reached on M-F 7:30-5:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on (571) 272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


RDL


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